THE B.C. TIDAL SPORTFISHING DIARY PROGRAM - 1982

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PREFACE

The B.C. Tidal Sportfishing Diary Program was initiated in 1979 to obtain estimates of the sport catch from B.C. tidal waters. Previous reports cover program development and annual results. This report deals with the 982 results and further developments in the program.

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THE B.C. TIDAL WATER SPORTFISHING DIARY PROGRAM - 1982

ABSTRACT

Bijsterveld, L. and B. Moore. 1984. The B.C. tidal water sportfishing diary program - 1982. Can. MS Rep. Fish. Aquat. Sci. 1759: V + 40 p.

An angler diary program collected 1982 catch and effort data from B.C. tidal water anglers. During 1,239,000 angler days British Columbia anglers caught and kept a total of 682,000 salmon including 196,000 chinook and 439,000 coho. The total salmon catch in 1982 was slightly higher than 1981, primarily due to a substantial increase in the coho catch. Catches of other species demonstrated relatively little change. Most effort was from boats and directed towards salmon in general. Catch per unit effort estimates are compared to other years and sources. Juvenile anglers caught and kept 29,000 chinook and 64,000 coho during 183,000 angler days. Problems and improvements related to the diary program are reviewed.

Keywords: sportfishing, tidal waters, logbook, catch statistics

RÉSUMÉ

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Au cours d'un programme de compte rendu de la pêche sportive, des données sur les prises et l'effort en 1982 ont été recueillies auprés des pêcheurs à la ligne dans les eaux à marée de la Colombie-Britannique. En 1 239 00 jours de péche, ces pécheurs ont capturé et gardé 682 000 saumons, dont 196 000 quinnats et 439 000 cohos. La prise totale de saumon en 1982 était légèrement supérieure à celle de 1981, augmentation principalement due à un accroissement important de la prise de coho. Les prises des autres espèces ont relative peu varié. L'effort a été déployé surtout à partir de bateaux et dirigé en général vers le saumon. On compare aussi les prises par unité d'effort avec celles d'autres années et d'autres sources. Les jeunes sportifs ont capturé et gardé 29 000 quinnats et 64 000 cohos pendant 183 000 jours de pêche à la ligne. Les auteurs examinent les améliorations et les problémes inhérents au programme de compte rendu.

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THE B.C. TIDAL SPORTFISHING DIARY PROGRAM - 1982

INTRODUCTION

Estimates of the sport catch were made by Department fishery officers since the early 1950's. Participation in the sport fishery grew in the 1960's and 1970's with no corresponding increase in manpower for collection of sport statistics. Independent studies in the late 1970's (Argue et al 1977, Harrison 1979) made it apparent that the Department could be underestimating the salmon sport catch by two to four times. Obviously, more reliable methods of estimating sport catch were necessary.

In a review of statistical problems and solutions for estimating sport catch, Brickley (1979) recommended a mail survey of B.C. residents based on quarterly activity. In response to this recommendation, the B.C. Tidal Sportfishing Diary Program was initiated in 1979. During the initial program years, methodology was developed and problems were identified. The major problem encountered was the lack of knowledge about the angler population due to the absence of a licensing program. Mail and telephone surveys of adult B.C. residents were used to identify anglers, yielding relatively small numbers of anglers participating in the program. This problem was resolved with the introduction of the B.C. Tidal Waters Sport Fishing Licence. The 1982 program was the first to use the license data base, accessing a larger number of anglers.

METHODOLOGY

B.C. resident anglers may purchase either a resident annual or resident/non-resident one day licence. A systematic sample of these licences was selected for the 1982 program. The licence information was keypunched directly from the licence stub to produce an address file. This file was used to produce address labels for three mailings of questionnaires. Most of the questionnaires (12,700) were sent out in November. Smaller numbers of questionnaires were sent out in February (700) and March (300) after sampling licences which were returned late to the Department of Fisheries.

Questionnaire reminders were sent to non-respondents three to four weeks after each questionnaire mailing.

Recipients of the postcard questionnaire were asked about their fishing activity in 1981 and whether they were willing to keep daily fishing records in 1982. A systematic sample of questionnaire non-respondents was surveyed by telephone to obtain the questionnaire information. The questionnaire and telephone survey data were used to adjust the potentially greater catch and effort of diary volunteers.

Questionnaire respondents volunteering to keep records were sent diary booklets. A total of four diaries, each covering one quarter of activity, were sent every three months. Each diary received served as a reminder to return the booklet from the previous quarter. Diary reminder letters were sent out after the end of the year.

Diarists were asked to record the following for each day of fishing: type of fishing (boat, shore, pier, bar or diving), party size, number of lines, time spent fishing, target species and statistical area. The catch of the following was also requested: chinook (under 18", 18" to 26", over 26"), coho (under 12", 12" and over), pink salmon, other salmon, lingcod, rockfish and crab. Diarists were asked to record the number caught and kept by the entire party, for each species.

RESULTS

Returns

The number of questionnaires sent out for the 1982 diary program was the largest number in the program history (Table 1). The questionnaire return rate was fairly consistent with other years. Questionnaire respondents were considered to be anglers if they indicated fishing during 1981. The

TABLE 1

RETURNS FROM THE TIDAL DIARY PROGRAM

QUESTIONNAIRES	1979	1980	1981	1982
Number sent out	9,978	10,176	1,940	13,747
Total possible contacts[1]	N/A	8,239	1,929	12,793
Number of returns	4,761 (48%)	6,184 (75%)	1,268 (66%)	8,575 (67%)
Number of anglers	1,307 (28%)	1,843 (30%)	1,268 (100%)	7,677 (90%)
Number of diary volunteers	595 (46%)	1,369 (75%)	922 (73%)	5,217 (68%)

DIARIES	1979	1980	1981	1982
Number of Returns:				
1st quarter	N/A	715 (52%)	838 (91%)	3,341 (64%)
2nd quarter	N/A	664 (49%)	703 (76%)	2,789 (53%)
3rd quarter	251 (42%)	622 (45%)	647 (70%)	2,350 (45%)
4th quarter	146 (24%)	593 (43%)	655 (72%)	1,738 (33%)
Number of active diary[2] fishermen	137 (23%)	321 (28%)	464 (50%)	2,094 (40%)

1 Total possible contacts = number sent out - undeliverable questionnaires

2 Diary fishermen fishing at least one day in 1982

proportion of anglers contacted was only surpassed by the proportion in 1981 when questionnaires were only sent to previously identified anglers. The proportion of anglers volunteering to keep diaries was somewhat lower than previous years but the actual number was at least four times the number of volunteers in any other year. Diary returns each quarter were consistent with other years.

Less than half of the diary volunteers actually fished in 1982. The number of active diarists contributing data to the program in 1982 was at least five times the number contributing in prior years.

Resident Sportfishing Population

The estimated number of 1982 B.C. resident adult anglers is provided in Table 2. The population is estimated from sport fishing licences and consists of adult B.C. resident tidal water anglers (aged 16 and over). The angling population is adjusted for activity because not all licence holders actually fish (Appendix C).

Catch

British Columbia resident anglers caught and retained 682,000 salmon in 1982 (Table 3). The catch consisted of 196,000 chinook, 439,000 coho and 46,700 other salmon. The total salmon catch increased 15 percent from 1981, primarily due to a 40 percent increase in the coho catch (Table 4). The chinook catch was similar to 1981 and still well below the catches for other years. The 1982 catch of other salmon was less than half of the 1981 catch. Historically, sport catches of other salmon have been dominated by pink salmon and have depended on the availability of pinks (DFO 1977). The number of pink salmon returning to rivers north of Vancouver Island to spawn in even numbered years (1982) is much smaller than the number that return to the Fraser River in "odd years" such as 1981 (Neave 1962).

TABLE 2

POPULATION OF ACTIVE B.C. RESIDENT TIDAL WATER ANGLERS

	Number of Anglers
1979	188,300[1]
1980	211,900[1]
1981	215,000[2]
1982	189,200[2]

[1]Aged 18 and over

[2]Aged 16 and over

Over half the salmon were taken during the summer months (June through August) in 1982. Chinook accounted for over half the total salmon catch during the winter (December to February) while coho accounted for over 50 percent from April through September. The South Coast and Fraser region was the major contributor to the salmon catch in 1982 (Table 5). This region accounted for over 75 percent of the chinook, 90 percent of the coho and 85 percent of the total salmon caught and kept in 1982.

British Columbia resident anglers caught and kept 161,000 lingcod and 321,000 rockfish during 1982. These catches increased more than 15 percent from 1981. The highest catches of lingcod and rockfish occurred from May through August (Table 6). About 75 percent of the lingcod and 70 percent of the rockfish were caught during these months. Most (90 percent) of the lingcod and rockfish were taken from the South Coast and Fraser region (Table 5). An estimated 140,000 crab were also caught and kept by B.C. resident anglers in 1982. The 1982 crab catch is 30 percent less than the 1981 catch. About 75 percent of the crab were taken from the South Coast and Fraser region.

Effort

Over 90 percent of the fishing effort occurred from boats in 1982. The percentage was even higher from June through September when interest in salmon is at its highest (Table 7). Fishing from the shore was at its highest level from January to April, corresponding to an increased interest in shellfish. Bar fishing was popular in Area 29 (Fraser River) and accounted for 19 percent of the effort in this area. Salmon fishing was prohibited at the mouth of the Fraser River in 1982. Many anglers may have moved east along the Fraser River to fish for salmon from the river bars. Most of the angling effort was directed towards salmon in general, particularly chinook and coho (Table 7).

The estimate of total effort by B.C. resident anglers in 1982 is 1,239,000 angler days. This was 20 percent lower than 1981 estimates. The

TABLE 3
1982 TIDAL SPORTFISHING DIARY PROGRAM

B.C. ADULT RESIDENT SALMON CATCH[1] AND EFFORT BY MONTH (000's)

Month	Angler Days	Chinook Kept	Coho Kept	Pink Salmon Kept	Other Salmon Kept	Total Salmon Kept
January	21.9	8.1	1.4	0.1	0.1	9.7
February	31.2	8.5	4.5	0.1	0.4	13.5
March	50.0	10.3	9.6	0.3	1.0	21.2
April	69.2	13.6	28.0	0.4	1.7	43.7
May	135.2	19.3	63.9	2.1	1.8	87.1
June	176.2	21.5	73.3	1.8	1.5	98.1
July	230.7	26.3	100.8	7.8	3.5	138.4
August	271.8	43.0	88.1	12.6	5.9	149.6
September	169.5	27.4	45.7	1.9	1.6	76.6
October	46.3	6.8	14.6	0.3	1.5	23.2
November	16.5	4.5	5.2	0.0	0.0	9.7
December	20.4	7.1	3.9	0.0	0.3	11.3
TOTAL	1,238.9	196.4	439.0	27.4	19.3	682.1

[1] Catch is reported in number of fish.

TABLE 4

ANNUAL CATCH[1] AND EFFORT - TIDAL DIARY PROGRAM

	1979[2]	1980	1981	1982
Angler days	419,700	850,700	1,520,900	1,238,900
Chinook kept	166,200	391,400	192,300	196,400
Coho kept	208,700	362,000	308,000	439,000
Other salmon kept	36,200	45,100	119,500	46,700
Total salmon kept	411,100	798,500	592,400	682,100
Lingcod kept	27,000	133,400	133,500	160,900
Rockfish kept	206,800	253,700	278,000	321,400
Crab kept	40,400	209,800	210,700	140,100

[1] Catch is reported in number of fish.

[2] Diary program was initiated in mid-year. Catches are for July to December.

TABLE 5

1982 TIDAL SPORTFISHING DIARY PROGRAM

B.C. ADULT RESIDENT CATCH[1] AND EFFORT BY REGION (000's)

		North and Central Coast (1-11)[2]	South Coast and Fraser (12-20, 28, 29)[2]	West Coast Vancouver Island (21-27)[2]	TOTAL (1-29)[2]
Angler Days		41.4	1,097.9	99.6	1,238.9
Chinook	Caught	24.5	376.4	47.9	448.8
	Kept	11.5	152.2	32.7	196.4
Coho	Caught	21.0	811.7	22.4	855.1
	Kept	11.8	413.6	13.6	439.0
Pink Salmon	Caught	4.7	29.1	0.6	34.4
	Kept	3.1	23.7	0.6	27.4
Other Salmon	Caught	1.8	21.9	2.8	26.5
	Kept	1.5	15.3	2.5	19.3
All Salmon	Caught	52.1	1,239.1	73.6	1,364.8
	Kept	28.0	604.8	49.3	682.1
Lingcod	Caught	6.5	185.4	16.7	208.6
	Kept	4.1	144.7	12.1	160.9
Rockfish	Caught	22.4	451.6	50.9	524.9
	Kept	15.7	284.9	20.8	321.4
Crab	Caught	41.8	212.5	26.3	280.6
	Kept	20.8	105.8	13.5	140.1

[1] Catch is reported in number of fish.

[2] Department of Fisheries statistical areas.

TABLE 6

1982 TIDAL SPORTFISHING DIARY PROGRAM

MONTHLY NON-SALMON CATCH[1] BY B.C. RESIDENT ADULTS (000's)

Month	Lingcod Kept	Rockfish Kept	Crab Kept
January	0.3	7.2	4.3
February	0.5	7.8	7.1
March	1.9	16.4	8.1
April	12.0	20.0	12.2
May	29.8	41.9	16.0
June	29.9	54.1	19.3
July	29.3	62.2	28.7
August	29.7	63.5	22.1
September	19.3	29.4	13.5
October	5.5	11.2	5.2
November	2.5	4.9	1.7
December	0.2	2.8	1.9
TOTAL	160.9	321.4	140.1

[1] Catch is reported in number of fish.

TABLE 7

1982 TIDAL SPORTFISHING DIARY PROGRAM

PERCENTAGE OF EFFORT DIRECTED TOWARDS DIFFERENT SPECIES

Month	Chinook	Coho	Other Salmon	Any Salmon	Groundfish	Shellfish	Any Fish	Other
Jan	50	2	0	25	9	9	1	4
Feb	42	3	0	30	7	11	2	5
Mar	33	5	0	32	10	11	4	5
Apr	25	14	0	36	12	10	1	2
May	22	18	0	40	11	5	2	2
Jun	21	22	0	41	10	4	1	1
Jul	16	24	0	43	9	5	2	1
Aug	21	23	0	44	7	3	1	1
Sep	22	26	0	40	6	2	2	2
Oct	16	29	0	37	9	3	3	3
Nov	22	12	2	46	11	3	2	2
Dec	41	3	0	45	2	5	3	1
TOTAL	22	21	0	41	9	4	2	1

South Coast and Fraser region accounted for almost 90 percent of the total effort in 1982. This region attracted anglers from many areas of B.C. as indicated in Table 8. For example, in the Campbell River area (statistical area 13), local residents accounted for less than half of the effort in that area. Generally, most coastal residents fish near where they live (Table 9). Residents of Victoria and the Lower Mainland fish away from home more than other coastal residents.

Catch/Effort

The average catch per angler day in 1982 was 0.16 chinook, 0.35 coho and 0.55 for all salmon combined. The catch rate of chinook is up slightly from 1981 while the coho catch rate increased 75 percent. Chinook catch rates were highest in the winter months (November through February) while coho catch rates were highest from May through July.

The average catch per angler day of sublegal salmon in 1982 was 0.19 chinook and 0.31 coho. The sublegal catch rates were highest from August through December and exceeded the catch rates of legal chinook and coho during this time. Anglers catch more sublegals during the latter half of the year because juvenile salmon feed heavily and grow rapidly during the summer. By August, they are large enough to be hooked by anglers but have not yet reached legal sizes.

Catch and Effort by Juvenile Anglers

The population of anglers aged 15 and under cannot be estimated from licence sales because these anglers are not required to purchase B.C. Tidal Water Sport Fishing Licences. An estimate can be obtained using questionnaire data. The number of active B.C. resident juvenile anglers in 1982 is estimated to be 56,000 (Appendix C).

TABLE 8

1982 TIDAL SPORT FISHING DIARY PROGRAM

ANGLER COMPOSITION (BY RESIDENCE AREA) IN EACH STATISTICAL AREA (PERCENTAGE ANGLER DAYS)

STATISTICAL AREAS

RESIDENCE AREAS*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
1	43	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	67	11	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	6	4	2	52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	45	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0
12	3	4	0	0	0	0	0	0	9	18	0	61	0	0	0	0	0	0	0	0	0	0	0	3	4	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	3	46	1	1	0	0	0	0	0	0	0	6	0	9	2	1	1	1
[illegible]	0	4	0	0	19	0	0	0	1	0	0	9	5	63	1	2	3	0	1	0	0	0	0	0	0	0	0	0	0
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	1	0	9	0	0	0	0	0	0	0	2	0	0	0	0	1	6
16	0	0	0	0	0	1	0	0	1	0	0	2	2	0	38	48	1	1	0	0	0	0	23	7	9	2	21	1	0	1
17	0	0	0	0	0	0	0	0	0	0	0	1	1	10	5	1	55	3	0	1	1	0	4	0	0	0	0	0	0
18	0	0	0	0	0	0	0	4	0	0	0	1	0	0	0	0	6	16	0	3	31	0	12	3	16	9	2	0	1
19	25	0	0	0	0	0	0	4	41	55	0	4	5	7	10	1	4	50	92	72	64	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	21	1	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	4	0	0	0	0	0	43	12	0	0	0	0	0
24	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0
25	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	65	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	7	69	0	0
28	5	6	0	0	0	2	0	23	6	9	0	2	5	3	8	15	5	3	0	0	1	15	1	12	1	1	0	29	20
29	0	6	4	7	33	3	55	18	42	18	0	13	21	11	23	28	21	24	4	1	0	62	15	26	0	0	20	67	68
South Int	5	0	1	0	0	8	0	14	0	0	0	3	13	3	3	4	2	1	1	0	0	0	8	6	4	0	1	3	2
North Int	0	3	26	30	43	50	0	21	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0

* Residence Areas 1 to 29 are Fisheries Statistical Areas. Interior Areas are outside of Statistical Area boundaries.

TABLE 9

1982 TIDAL SPORT FISHING DIARY PROGRAM

DISPERSION OF ANGLERS FROM EACH RESIDENCE AREA TO STATISTICAL AREAS FOR FISHING (PERCENTAGE ANGLER DAYS)

RESIDENCE AREAS*	STATISTICAL AREAS																												
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
1	55	6	0	0	0	0	0	0	0	0	0	0	0	2	0	0	37	0	0	0	0	0	0	0	0	0	0	0	0
2	0	95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2
3	0	0	76	21	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	5	5	2	88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	99	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	36	64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	1	0	0	0	0	0	0	1	0	0	95	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
13	0	0	0	0	0	0	0	0	0	0	0	2	93	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	3	4	82	0	2	3	0	0	0	0	0	3	0	0	0	0	1	1
15	0	0	0	0	0	0	0	0	0	0	0	0	30	0	70	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	1	2	0	7	79	1	1	0	0	0	0	2	0	0	0	0	0	7
17	0	0	0	0	0	0	0	0	0	0	0	0	1	15	1	2	69	4	0	1	0	0	5	0	0	1	0	0	1
18	0	0	0	0	0	0	0	0	0	0	0	1	1	2	0	1	22	56	0	5	3	0	8	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	1	0	0	1	2	5	1	1	2	24	42	16	1	0	3	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	1	7	7	79	0	0	1	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	3	13	0	1	0	0	0	74	1	0	0	0	0	0
24	67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	0	0	0	0	11
25	3	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	7	0	0	0	0	8	80	0	0	0	1
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	4	84	0	0
28	0	0	0	0	0	0	0	1	0	0	0	1	6	5	2	24	8	4	0	0	0	0	0	0	0	0	0	24	23
29	0	0	0	0	0	0	0	0	0	0	0	2	7	6	1	15	9	10	2	0	0	0	4	0	0	0	1	17	24
South Int	0	0	0	0	0	2	0	1	0	0	0	4	32	12	1	13	5	3	2	0	0	0	14	0	1	0	0	5	5
North Int	0	1	8	16	3	45	0	5	0	0	0	0	3	2	1	2	0	2	2	5	0	0	2	0	0	0	0	0	0

* Residence Areas 1 to 29 are Fisheries Statistical Areas. Interior Areas are outside of Statistical Area boundaries.

Surveys other than the Tidal Diary Program (Cox 1977, Cumming 1979, Pelletier, Lacasse and Ducharme 1981, Thomson 1974) indicate that the average number of days fished by juvenile anglers is about one to two thirds the average number of days fished by adult anglers (Table 10). Juvenile tidal water anglers fished an estimated 183,000 angler days in 1982, assuming that each juvenile angler fishes half as many days as an adult.

The catch estimates obtained from the Diary Program are based on party catches reported in the diaries, which include catches by juvenile anglers accompanying adult diarists. Using the catch rates (catch per unit effort) estimated from the diaries, juvenile tidal water anglers caught an estimated 29,000 chinook and 64,000 coho in 1982.

DISCUSSION

Angler Identification

One of the major problems confronted during development of the Tidal Diary Program was identification of B.C. tidal water anglers. Mail and telephone surveys were the only means of identifying anglers in the absence of a licence system. The B.C. Tidal Waters Sport Fishing Licence was introduced in April, 1981. The licence program was initiated too late to be utilized for the 1981 Tidal Diary program but the licences were used for the 1982 program. The 1982 questionnaire was sent to a sample of 1981 licence holders and 90% of the returns were from active anglers. Obviously there is a greater probability of contacting an active angler from a sample of fishing licence holders than from a sample of the general public. The 1982 program had four to six times as many questionnaire returns from anglers than any other year of the program. This large volume of questionnaire data improves the reliability of the weighting factors used in the analysis (Appendix C). The large number of angler contacts also yielded a much larger number of diary volunteers than ever before.

TABLE 10

EFFORT BY ADULT AND JUVENILE ANGLERS

	Average Days Fished:		Juvenile/
	Adult	Juvenile	Adult
Newfoundland (Cox 1977)	26.4	17.6	.67
Nova Scotia (Cumming 1979)	19.6	7.7	.39
P.E.I. (Thomson 1974)	13.7	9.2	.67
Quebec (Pelletier, Lacasse and Ducharme 1981)	12.9	4.9	.38
B.C. Freshwater (1980)	17.43	9.59	.55

The licence program also simplifies the estimation of the number of tidal water anglers. The number of B.C. resident anglers is simply a proportion of the total licence sales. Anglers from outside of B.C. can also be identified and their number estimated through the licence program. Estimation of the catch and effort from other than B.C. resident anglers through other surveys is now more practical.

The licence program only identifies adult tidal water anglers since anglers aged 15 or less are not required to purchase a licence. The number of active juvenile tidal water anglers is estimated at 56,000 in 1982, compared to 189,200 active adult anglers. Therefore, juvenile anglers represent a significant proportion (almost 25%) of the total resident tidal water anglers and are still not easily accessible.

Survey Bias

Certain types of error are associated with mail surveys such as the Tidal Diary Program. The estimates obtained from mail surveys could be suspect if these problems are not addressed. One source of error is referred to as recall bias and arises because individuals cannot always accurately recall details after time has passed. The result could be either under or over estimating, depending on the subject. The use of diary booklets eliminates the problem of recall bias because the books are filled out as fishing occurs.

Another problem with mail surveys is non-response bias. Individuals that voluntarily return a questionnaire are probably more interested in the questionnaire subject. Tidal Diary questionnaire respondents could be more active and successful anglers than the non-respondents. Estimates of participation and angler activity would be biased upwards. This bias can be corrected by obtaining information about the non-respondents. A sample of non-respondents was surveyed by telephone in 1982.

The survey results indicate that 76.8% of the non-respondents actually fished, compared to 89.5% of the respondents. A chi-square test indicated a difference in these participation rates at the .05 level of significance. The average days fished and salmon catches of active respondents and non-respondents are provided in Table 11. The average days fished by all groups in the table are significantly different as indicated by t-tests at the .05 level of significance. The number of salmon caught by active diarists and by questionnaire respondents in general are different, as indicated by t-tests at the .05 level of significance. The same tests indicate no difference between the catches by questionnaire respondents and non-respondents. Active diarists fish more days and catch more fish on the average. The greater activity and fishing success of the diary fishermen are taken into account when catch and effort are estimated for the general fishing population (Appendix C).

Comparability of Results

Comparing the estimates obtained from the Diary Program to estimates from other sources should give an indication of the reliability of the Diary estimates. The only other 1982 estimates available are those obtained from the Georgia Strait Creel Survey. The sample base of the Creel Survey is all anglers (B.C. residents, visitors, juveniles) fishing from boats in Georgia Strait (Department of Fisheries statistical areas 13-19, 28, 29). The Tidal Diary Program samples adult B.C. resident anglers only but estimates of catch and effort by visitors and juvenile anglers can be added to make the estimates comparable to the creel survey estimates. The resultant Tidal Diary and Creel Survey estimates are provided in Table 12. The estimates of total effort from both sources are very similar. The salmon catches estimated from the Tidal Diary Program and Visitor survey are higher than those obtained from the Creel Survey although the 95% confidence intervals overlap.

TABLE 11

1982 TIDAL SPORTFISHING DIARY PROGRAM

COMPARISON OF ANGLER ACTIVITY IN 1981

	Active 1982 Diarists	All Questionnaire Respondents	Non-Respondents
Average Days Fished	22.01	14.51	8.5
Average Chinook Catch	4.9	2.8	2.4
Average Coho Catch	5.5	3.5	3.2

TABLE 12

GEORGIA STRAIT[1] CATCH AND EFFORT - 1982

	Creel Survey	Tidal Diary (adjusted[2])
Angler Days	1,355,000[3]	1,460,700
Chinook Kept	165,500	224,900
Coho Kept	454,200	585,600
Catch/Effort:		
Chinook	.12	.14[4]
Coho	.34	.38[4]

1 DFO statistical areas 13-19, 28, 29.

2 Combined estimates from Tidal Diary Program (adult and juvenile residents) and Visitors Sportfishing Survey.

3 Angler days = boat days x average party size (from Tidal Diary Program).

4 These are the catch rates estimated from the Tidal Diary Program only. The 1982 Visitor Survey was in a development stage and the resultant estimates may not be as reliable as the Tidal Diary Program estimates.

Confidence Intervals

The 95% confidence intervals for the 1980 through 1982 estimates are provided in Table 13. The 1982 confidence intervals for the coastwide estimates of catch and effort are wider than those obtained in previous years. The 1982 confidence intervals for Statistical Area 29 are narrower than previous years and also narrower than the coastwide interval. Fishing activity in one statistical area should be less variable than coastwide fishing activity, as demonstrated in 1982. The variance estimates obtained in 1982 are probably better indicators of population variance than the estimates obtained in previous years.

The 1982 95% confidence intervals for estimates obtained from the Tidal Sportfishing Diary Program and Georgia Strait Creel Survey are presented in Table 14. The confidence intervals for both programs are similar. This implies that the variance estimates from both sources are similar and equally reliable as indicators of population variance.

TABLE 13

TIDAL SPORTFISHING DIARY PROGRAM

95% CONFIDENCE INTERVALS[1] - 1980 - 1982

Statistical Area 29	1980	1981	1982
Angler Days	17%	19%	6%
Chinook Kept	40%	42%	22%
Coho Kept	50%	45%	28%
North and Central Coast (1 - 11)[2]			
Angler Days	NA	44%	27%
Chinook Kept	NA	85%	62%
Coho Kept	NA	138%	77%
West Coast Vancouver Is. (21 - 27)[2]			
Angler Days	NA	22%	15%
Chinook Kept	NA	47%	27%
Coho Kept	NA	70%	56%
South Coast and Fraser (12 - 20, 28, 29)[2]			
Angler Days	7%	6%	7%
Chinook Kept	16%	16%	19%
Coho Kept	18%	15%	17%
Coastwide (1 - 29)[2]			
Angler Days	7%	5%	8%
Chinook Kept	16%	15%	23%
Coho Kept	19%	14%	20%

1 Confidence Intervals are expressed as percentage of estimate.
2 Dept. of Fisheries and Oceans statistical areas.

TABLE 14

TIDAL DIARY PROGRAM AND CREEL SURVEY

MONTHLY 95% CONFIDENCE INTERVALS[1]

	Tidal Diary Program (South Coast & Fraser)[2]			Creel Survey (Georgia Strait)[3]		
Month	Effort (Angler Days)	Chinook Kept	Coho Kept	Effort (Boat Days)	Chinook Kept	Coho Kept
Jan	12%	26%	79%	NA	NA	NA
Feb	8%	22%	70%	NA	NA	NA
Mar	9%	22%	43%	NA	NA	NA
Apr	8%	19%	25%	NA	NA	NA
May	6%	15%	18%	21%	14%	41%
Jun	6%	15%	17%	9%	9%	13%
Jul	5%	13%	12%	8%	9%	9%
Aug	6%	17%	15%	7%	9%	9%
Sep	6%	20%	16%	14%	19%	29%
Oct	10%	38%	27%	17%	29%	21%
Nov	14%	33%	58%	20%	26%	35%
Dec	16%	32%	58%	19%	21%	40%

[1] Confidence intervals are expressed as percentage of estimate.
[2] Department of Fisheries and Oceans statistical areas 12 - 20, 28, 29.
[3] Department of Fisheries and Oceans statistical areas 13 - 19, 28, 29.

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APPENDIX A

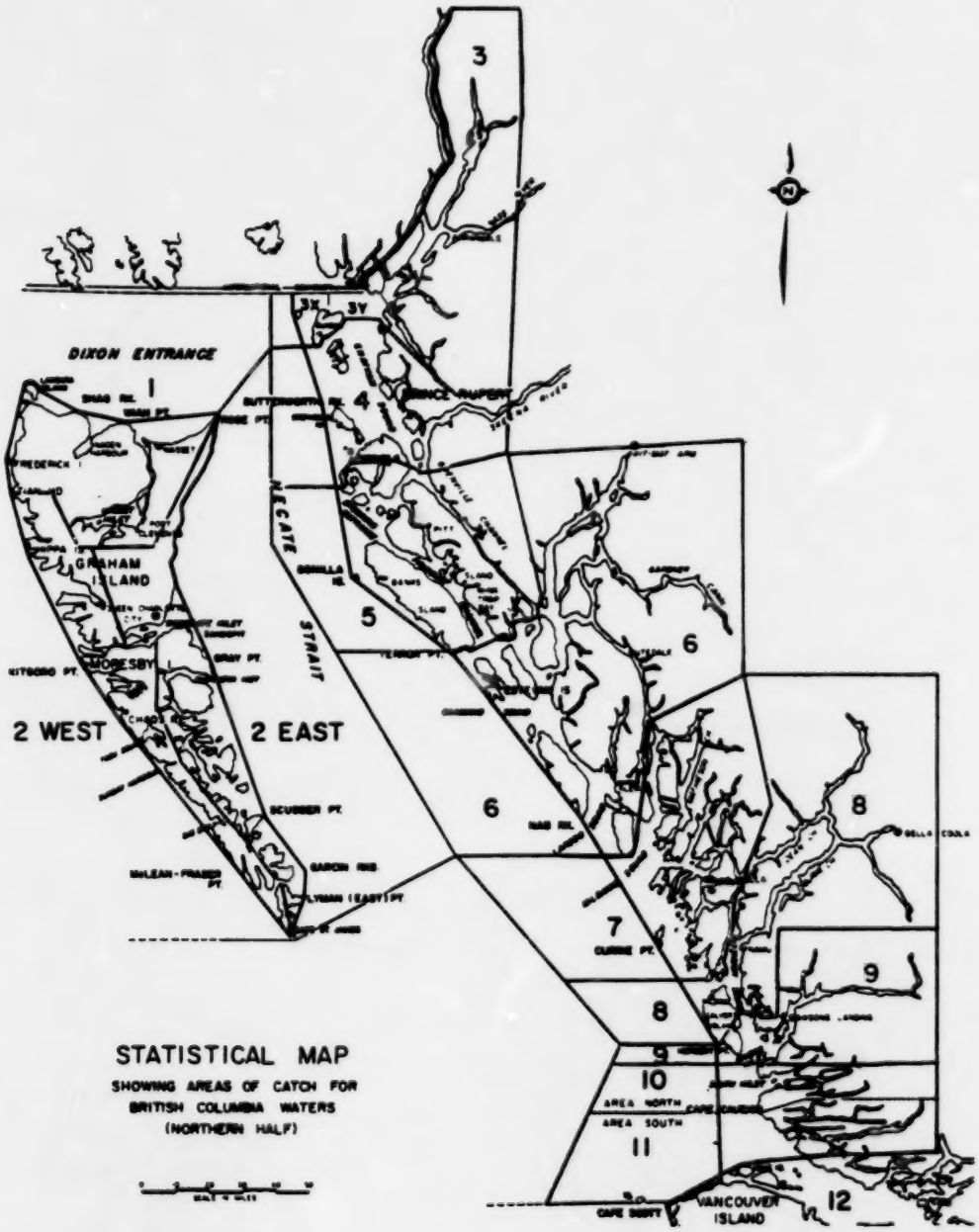
Species Lists

Common and Scientific Names of Fish Recorded by B.C. Tidal Water Anglers (Diary Program)

Common Name	Scientific Name
Chinook salmon	*Oncorhynchus tschawytscha*
Coho salmon	*Oncorhynchus kisutch*
Pink salmon	*Oncorhynchus gorbuscha*
Rockfish	*Sebastes* spp
Lingcod	*Ophiodon elongatus*
Crab	*Cancer* spp,
	Paralithodes camschatkana

APPENDIX B

Statistical Area Maps



CAPE SCOTT
CAPE RUSSELL
27
QUATSINO SOUND
LAWN PT.
CAPE COOK
CLERKE PT.
26
LOOKOUT IS.
KYUQUOT SOUND
ESPERANZA INLET
TURNER PT.
25
NOOTKA SOUND
NOOTKA
ESTEVAN PT.
24
RAFAEL PT.
CLAYOQUOT SOUND
TOFINO
COX PT.
23
SCARLETT
BARKLEY SOUND
CAPE BEALE
PACHENA PT.
21
CAPE FLATTERY
BONILLA PT.
22
STRAIT OF JUAN DE FUCA
20
18
19
VICTORIA
NANAIMO
17
STRAIT OF GEORGIA
14
12
13
15
16
29
28
VANCOUVER
PORT ROBERTS
BRITISH COLUMBIA
U. S. A.
STATISTICAL MAP
SHOWING AREAS OF CATCH FOR
BRITISH COLUMBIA WATERS
(SOUTHERN HALF)

APPENDIX C

1. Estimating the Population of Anglers

The population of B.C. resident anglers was estimated using mail or telephone survey results prior to 1982. The introduction of the B.C. Tidal Waters Sportfishing Licence in April, 1981 provided a means of identifying all B.C. anglers. Licences are purchased by anglers fishing in B.C. waters, not just B.C. resident anglers. B.C. residents may purchase either a resident of Canada annual or resident/non-resident one-day licence. A systematic sample of these licences was selected to receive questionnaires. The proportion of licences purchased by B.C. residents can be determined from the sample.

From the licence sales, the estimated number of B.C. resident anglers is:

$$ANG = (RSALES \times RBC) + (DSALES \times DBC)$$

where ANG = estimated number of anglers

RSALES = total resident annual licence sales

RBC = proportion of B.C. residents purchasing resident annual licences

DSALES = total one-day licence sales

DBC = proportion of B.C. residents purchasing one-day licences

2. Participation Rates

Past surveys have shown that purchasing a licence does not necessarily mean that an individual will use it. Therefore, the total estimated population of anglers is corrected for non-participation by multiplying by a participation rate.

The estimated population of active anglers is:

$$ANGA = ANG \times PART$$

where ANGA = estimated population of active anglers

ANG = estimated population of anglers

PART = participation rate

From questionnaire data, the participation rate is:

$$\frac{ANGQ}{RESQ + NRESQ}$$

where ANGQ = estimated number of anglers who fished among all possible questionnaire respondents

RESQ = questionnaire respondents

NRESQ = questionnaire non-respondents

and RESQ + NRESQ = total possible contacts

$$ANGQ = ANGRQ + \left[\frac{ANGT}{REST} \times NRESQ\right]$$

where ANGRQ = number of questionnaire respondents who fished

ANGT = anglers identified in telephone survey

REST = successful telephone contacts

3. Effort by Statistical Area and Month

Total effort in statistical area j is estimated from the number of days fished in that area in month k by diary fishermen. The number of angler days fished by diary fishermen is weighted (using questionnaire data) to correct for the greater average effort by diary fishermen. The questionnaire data are

corrected for non-response using the results of the telephone survey. The estimated number of active anglers among questionnaire non-respondents is:

$$ANGNQ = \frac{ANGT}{REST} \times NRESQ$$

where ANGNQ = anglers among non-respondents

ANGT = anglers identified in telephone survey

REST = successful telephone contacts

NRESQ = questionnaire non-respondents

The number of anglers among all possible questionnaire contacts is:

$$ANGQ = ANGNQ + ANGRQ$$

where ANGQ = estimated number of anglers fishing in 1982 among all possible respondents

ANGRQ = anglers among the respondents

The average number of days fished in 1981 (from the questionnaire) corrected for non-response is:

$$DAYS = \frac{(ANGRQ \times DAYSQ) + (ANGNQ \times DAYST)}{ANGQ}$$

where DAYS = average number of days fished in 1981 by all possible questionnaire contacts

ANGRQ = anglers among the respondents

DAYSQ = average number of days fished by questionnaire respondents

ANGNQ = anglers among non-respondents

DAYST = average number of days fished from the telephone survey of non-respondents

ANGQ = anglers among total possible contacts

The total effort in each statistical area j and month k is:

$$EFFORT_{jk} = \left(\sum_{i} EFFORTD_{ijk} \right) \times \frac{DAYS}{DAYSD} \times \frac{ANGA}{ANGDF}$$

where $EFFORT_{jk}$ = total angler days fished in statistical area j in month k

$EFFORTD_{ijk}$ = angler days fished by diary fisherman (i) in statistical area j and month k

DAYS = average number of days fished in 1981 from the questionnaire

DAYSD = average number of days fished in 1981 by diary fishermen fishing at least one day in 1982

ANGA = total population of active anglers

ANGDF = active diary fishermen who fished at least one day in 1982

The term $\frac{DAYS}{DAYSD}$ is the weighting factor used to correct the greater effort of diary fishermen

The term $\frac{ANGA}{ANGDF}$ projects the effort of diary fishermen to the total population of active anglers

4. Catch by Statistical Area and Month

The total catch of species s in statistical area j and month k is estimated from the catch by diary fishermen. The catch recorded in the diaries is the total party catch. Each catch record is divided by the party size to obtain the catch by an individual angler. The catch of each species is weighted (using questionnaire data) to correct for the possible greater fishing success of diary fishermen. The questionnaire data are corrected for non-response bias using the results of the telephone survey.

$$CATCH_s = \frac{(ANGRQ \times CATCHQ_s) + (ANGNQ \times CATCHT_s)}{ANGQ}$$

where $CATCH_s$ = average catch of species s in 1981 by all possible questionnaire contacts

ANGRQ = anglers among questionnaire respondents

$CATCHQ_s$ = average catch of species s in 1981 by questionnaire respondents

ANGNQ = anglers among non-respondents

$CATCHT_s$ = average catch of species s in 1981 from the telephone survey of non-respondents

ANGQ = anglers among total possible questionnaire contacts

Total catch of each species s is:

$$SPECIES_{jks} = \left(\sum_i SPECIESD_{ijks} \right) \times \frac{CATCH_s}{CATCHD_s} \times \frac{ANGA}{ANGDF}$$

$SPECIES_{jks}$ = total catch of species s in statistical area j and month k.

$SPECIESD_{ijks}$* = total catch of species s by diary fisherman (i) in statistical area j and month k.

$CATCH_s$ = average catch of species s in 1981 by questionnaire recipients fishing in 1981.

$CATCHD_s$ = average catch of species s in 1981 by diary fishermen fishing in 1982.

ANGA = estimated number of active anglers in 1982.

ANGDF = the number of active diary fishermen in 1982.

The term $\frac{CATCH_s}{CATCHD_s}$ Greater fishing success of diary fishermen.

The term $\frac{ANGA}{ANGDF}$ anglers.

* Since the reported catch by diary fishermen is party catch,

$$SPECIESD_{jks} = \sum_i \left[\frac{PARTY\ CATCH_i}{PARTY\ SIZE_i} \right]_{jks}$$

5. Estimating Catch and Effort by Juvenile Anglers

Adult B.C. resident anglers are identified by B.C. Tidal Waters Sport Fishing Licences. Licences are only required by individuals aged 16 and over and do not provide information about juvenile anglers younger than 16. The numbers of active juvenile anglers can be estimated from questionnaire data.

The estimated number of active juvenile anglers is:

$$JUVA = \frac{JUVQ}{RESQ} \times ANG$$

Where JUVA = estimated number of juvenile anglers
JUVQ = total number of active juvenile anglers associated with questionnaire respondents
RESQ = questionnaire respondents
ANG = estimated number of B.C. resident anglers

Results of surveys other than the Diary Program indicate that juvenile anglers fish about half as many days as their adult counterparts. The estimated effort by juvenile anglers is:

$$EFFORTJ = JUVA \times \frac{EFFORT}{ANGA} \times .50$$

Where: EFFORTJ = estimated effort by juvenile anglers
JUVA = estimated number of juvenile anglers
ANGA = estimated population of active adult anglers
EFFORT = estimated effort by active adult anglers

The catch reported in the diary booklets is party catch and should include juveniles fishing with adult anglers. Therefore, the catch rate (catch per unit effort) estimated from the diaries is the same for adults and juveniles. The catch by juvenile anglers is estimated to be:

$$CATCHJ = EFFORTJ \times \frac{CATCH}{EFFORT}$$

Where: CATCHJ = estimated catch by juvenile anglers

EFFORTJ = estimated effort by juvenile anglers

CATCH = estimated catch by adult anglers

EFFORT = estimated effort by adult anglers

6. Confidence Interval Calculation

The confidence interval for an estimated variable $\hat{X}$ can be expressed as

$$\hat{X} - t_{.05(2)} S_{\hat{X}} < \hat{X} < \hat{X} + t_{.05(2)} S_{\hat{X}}$$

with a .95 probability that the true value (X) is within the interval. The variables of interest ($\hat{X}$) for confidence interval calculation are total catch and effort (days fished). These variables are estimated as follows:

$$\text{Total } \hat{X}_j = W\left(\sum_i \hat{X}_{ij}\right)$$

Where: Total $\hat{X}_j$ = the total catch or effort in statistical area j

W = the population weight times the bias correction factor for catch or effort

$\hat{X}_{ij}$ = the catch or days fishing by and individual (i) fishing in statistical area j

The estimated variances of the total are calculated:

$$S^2(\hat{X}_j) = W^2 \left(\sum_i S^2(\hat{X}_{ij})\right)$$

with the following assumptions:

1. Weights (W) were measured without error[1]
2. Areas (j) fished are independent.

Confidence intervals were calculated for statistical area 29, regions and the entire coast and are presented in Table C-1.

[1] Since the weights were estimated from questionnaire data, this assumption may be invalid. The variance calculation including estimation error is prohibitively expensive and, therefore, not feasible. The confidence intervals presented here are the minimum expected.

TABLE C-1

1982 TIDAL SPORTFISHING DIARY PROGRAM

95% CONFIDENCE LIMITS ('000's)

	Statistical Area 29	North & Central Coast (1 - 11)[1]	South Coast & Fraser (12 - 20 28, 29)[1]	West Coast Vancouver Island (21 - 27)[1]	Coastwide (1 - 29)[1]
Angler Days	105.2 ± 6.4	41.4 ± 11.3	1097.9 ± 73.8	99.6 ± 15.4	1238.9 ± 100.6
Chinook[2]	12.2 ± 2.7	11.5 ± 7.1	152.2 ± 28.2	32.7 ± 8.9	196.4 ± 44.2
Coho[2]	13.4 ± 3.7	11.8 ± 9.1	413.6 ± 72.3	13.6 ± 7.6	439.0 ± 89.0
Pink[2] Salmon	.3 ± .3	3.1 ± 3.3	23.7 ± 12.2	.6 ± .7	27.4 ± 16.2
Other[2] Salmon	2.1 ± 1.6	1.5 ± 2.0	15.3 ± 11.3	2.5 ± 2.1	19.3 ± 15.4
Lingcod[2]	4.4 ± 1.6	4.1 ± 4.5	144.7 ± 33.7	12.1 ± 4.6	160.9 ± 44.7
Rockfish[2]	9.1 ± 2.7	15.7 ± 11.6	284.9 ± 66.9	20.8 ± 10.2	321.4 ± 115.6
Crab[2]	9.3 ± 3.8	20.8 ± 12.4	105.8 ± 38.4	13.5 ± 9.6	140.1 ± 60.3

[1] Department of Fisheries and Oceans Statistical Areas
[2] Catches are number of fish kept

APPENDIX D

Sample Forms

1. Tidal Diary Questionnaire

1982 TIDAL DIARY QUESTIONNAIRE

(To be filled in by the person named in the address)

1. Please indicate the number of other people in your household not including yourself who sportfished in B.C. tidal waters in 1981. If none, enter 0.

   (a) 16 and over _____ (b) Under 16 _____

2. Did you personally fish in B.C. tidal waters in 1981? YES _____ NO _____

   If yes, please indicate the number of days you fished each month (A day means all or any part of a day)

Jan. ___	Apr. ___	July ___	Oct. ___
Feb. ___	May ___	Aug. ___	Nov. ___
Mar. ___	June ___	Sept. ___	Dec. ___

3. On how many days did you go fishing and catch no salmon? _____

4. How many of each species did you personally catch in B.C. tidal waters in 1981? If none, please enter 0.

   (a) Chinook salmon ___ (d) Crab ___

   (b) Coho salmon ___ (e) Clams ___

   (c) Other finfish ___ (f) Other Shellfish ___

5. Would you be willing to keep a record of your 1982 fishing activity for us in books that we will provide?

   YES _____ NO _____

Business Reply Mail
No Postage Stamp Necessary if mailed in Canada

Postage will be paid by

Canada Post Postes Canada 5112

TIDAL SPORTFISHING DIARY PROGRAM
Department Of Fisheries And Oceans
1090 West Pender Street
Vancouver, B.C.
V6E 9Z9

2. Tidal Sportfishing Diary Form (a)

PLEASE SEE INSTRUCTIONS
ON THE FIRST PAGE
BEFORE FILLING OUT DIARY

Please record

all days fished

even if you

caught nothing.

Questions? Phone (604) 666-6501 Collect!

DATE	Total anglers	Type of fishing	Lines	Hours fishing	Target species	Statistical area

Tidal Sportfishing Diary Form (b)

BOAT or PARTY CATCH

CHINOOK					COHO			PINK SALMON		OTHER SALMON		LING COD		ROCK FISH		CRABS		OTHER SPECIES _____	
Under 18" Caught & Released	18" to 26"		Over 26"		Under 12" Caught & Released	12 & Over													
	Caught	Kept	Caught	Kept		Caught	Kept	Caught	Kept	Caught	Kept	Caught	Kept	Caught	Kept	Caught	Kept	Caught	Kept